

REMARKS

In the last Office Action, claims 17-18 were rejected under 35 U.S.C. §112, second paragraph, for indefiniteness. Claims 1-11, 13, 14 and 16-18 were rejected under 35 U.S.C. §112, second paragraph, as being incomplete for omitting essential structural cooperative relationships of elements. Claims 1, 2, 3/1, 3/2, 4, 5, 6/1, 6/2, 9, 10, 11/1, 13, 16 and 18 were rejected under 35 U.S.C. §102(a) as being clearly anticipated by U.S. Patent No. 5,783,899 to Okazaki, U.S. Patent No. 5,917,268 to Takagi, and U.S. Patent No. 6,064,140 to Zumeris. Claims 17-18 were rejected under 35 U.S.C. §102(a) as being clearly anticipated by U.S. Patent No. 5,477,100 to Kataoka or U.S. Patent No. 6,175,181 to Shirasaki. Claims 1, 3/1, 5, 6/1 and 18 were rejected under 35 U.S.C. §103(a) as being unpatentable over Japanese Patent No. 2-202382 ("Japan '382") in view of Okazaki, Takagi or Zumeris. Claims 7-8 were indicated to be allowable if amended to overcome the rejection under 35 U.S.C. §112, second paragraph, and to include all of the limitations of the base claim and any intervening claims. Claims 12 and 15 were objected to as being dependent upon a rejected base claim, but indicated to be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Additional art was cited of interest.

Applicants and applicants' counsel note with appreciation the indication of allowable subject matter

concerning claims 7, 8, 12 and 15. However, for the reasons noted below, applicants respectfully submit that amended claims 1, 2, 3/1, 6/1, 7-9, 11/1, 12-17 and 18 and newly added claims 19-40 also patentably distinguish from the prior art of record.

In accordance with the present response, the specification has been suitably revised to correct informalities and place it in better conformance with U.S. practice. Original claims 1, 3/1, 6/1, 7-9, 11/1, 12-17 and 18 have been amended to overcome the rejections under 35 U.S.C. §112, second paragraph, and in formal respects to improve the wording thereof. Claims 3/2, 4, 5, 6/2, 10 and 11/2 have been canceled. New claims 19-40 have been added to cover the subject matter of original claims 3/2, 6/2 and 11/2 and to provide a fuller scope of coverage. A proposed drawing revision has been submitted in Fig. 16, and a new abstract which more clearly reflects the invention to which the claims are directed has been substituted for the original abstract.

In view of the foregoing amendments to the claims, applicants respectfully submit that the rejections under 35 U.S.C. §112, second paragraph, have been overcome and should be withdrawn.

Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached pages i-viii are captioned "VERSION WITH MARKINGS TO SHOW CHANGES MADE".

Applicants respectfully request reconsideration of their application in light of the following discussion.

The present invention is directed to an ultrasonic motor and to an electronic apparatus equipped with the ultrasonic motor.

As described in the specification (pgs. 1-3), the thickness of the vibrating body of conventional ultrasonic motors must be increased in order to obtain displacement of the moving body in a feed direction. The increase in thickness of the vibrating body increases the resonant frequency which adversely affects the driving efficiency and stability of the ultrasonic motor.

The present invention overcomes the drawbacks of the conventional art. Figs. 1-3 show an embodiment of an ultrasonic motor according to the present invention embodied in the claims. The ultrasonic motor has a vibrating body 1 and a piezoelectric element 2 disposed on the vibrating body 1 for generating a vibration wave to vibrate the vibrating body. The vibration wave generated by the piezoelectric element 2 has a vibration node disposed on a diagonal line 10a of the vibrating body 1. At least one protrusion 1a is connected to the vibrating body 1 for vibration therewith. The protrusion 1a is disposed on the vibrating body 1 at a position which does not correspond to the position of the vibration node of the vibration wave. A moving body 8 is disposed in contact

with and is driven (i.e., rotates in the directions denoted by arrows 12, 13 in Fig. 2) by the protrusion 1a during vibration thereof.

In another embodiment, the vibration wave generated by the piezoelectric element 2 has a vibration node disposed on a line connecting a center of a first side of the vibrating body 1 and a center of a second side of the vibrating body 1 opposite to the first side.

Preferably, in the foregoing embodiments according to the present invention embodied in the claims, the vibrating body 1 is generally quadrilateral-shaped. The piezoelectric element 2 has a plurality of electrodes 3a-3e (Fig. 3) for generating a bending vibration wave in a thickness direction of the vibrating body 1.

By the foregoing construction, an ultrasonic motor having improved driving efficiency and stability is provided as compared to the conventional art. For example, the output characteristic of the ultrasonic motor according to the present invention is constant regardless of the thickness of the vibrating body and the direction of rotation of the moving body. Furthermore, the resonant frequency of the ultrasonic motor of the present invention is decreased, thereby obtaining an increase in amplitude. Additionally, by providing a vibrating body which is generally quadrilateral-shaped, mass-production of the vibrating bodies is facilitated.

Applicants respectfully submit that the prior art of record does not disclose or suggest the subject matter recited in amended claims 1, 2, 3/1, 6/1, 7-9, 11/1, 12-17 and 18 and newly added claims 19-40.

Claims 1, 2, 3/1, 6/1, 9, 11/1, 13, 16 and 18 were rejected under 35 U.S.C. §102(a) as being clearly anticipated by Okazaki, Takagi or Zumeris. Applicants respectfully traverse this rejection and submit that amended claims 1, 2, 3/1, 6/1, 9, 11/1, 13, 16 and 18 recite subject matter which is not identically disclosed or described in Okazaki, Takagi and Zumeris.

Amended independent claim 1 is directed to an ultrasonic motor and requires a vibrating body, a piezoelectric element disposed on the vibrating body for generating a vibration wave to vibrate the vibrating body, the vibration wave having a vibration node disposed on a diagonal line of the vibrating body, at least one protrusion connected to the vibrating body for vibration therewith, the protrusion being disposed on the vibrating body at a position which does not correspond to the position of the vibration node, and a moving body disposed in contact with and driven by the protrusion during vibration thereof.

Amended independent claim 2 is also directed to an ultrasonic motor and requires a vibrating body, a piezoelectric element disposed on the vibrating body for

generating a vibration wave to vibrate the vibrating body, the vibration wave having a vibration node disposed on a line connecting a center of a first side of the vibrating body and a center of a second side of the vibrating body opposite to the first side, at least one protrusion connected to the vibrating body for vibration therewith, the protrusion being disposed on the vibrating body at a position which does not correspond to the position of the vibration node, and a moving body disposed in contact with and driven by the protrusion during vibration thereof.

Okazaki discloses an ultrasonic vibration motor having a linear elastic body which contacts a relative movement member, piezoelectric elements connected to the elastic body, and waveform generators for generating drive signals producing waveforms. Takagi discloses a vibration driven motor having an elastic member and an electro-mechanical converting element connected to the elastic member. Zumeris discloses a ceramic motor having a rectangular piezoelectric plate, electrodes attached to the piezoelectric plate, and a moving body driven by vibrations generated when a drive signal is applied between the electrodes.

However, neither Okazaki, Takagi nor Zumeris discloses or describes the structure and corresponding function of the ultrasonic motor recited in amended independent claims 1 and 2. More specifically, Okazaki,

Takagi and Zumeris do not disclose or describe a piezoelectric element disposed on the vibrating body for generating a vibration wave having a vibration node disposed on a diagonal line of the vibrating body, and at least one protrusion connected to the vibrating body for vibration therewith and disposed on the vibrating body at a position which does not correspond to the position of the vibration node, as required by amended claim 1. Likewise, the references do not disclose or describe a piezoelectric element disposed on the vibrating body for generating a vibration wave having a vibration node disposed on a line connecting a center of a first side of the vibrating body and a center of a second side of the vibrating body opposite to the first side, and at least one protrusion connected to the vibrating body for vibration therewith and disposed on the vibrating body at a position which does not correspond to the position of the vibration node, as recited in amended claim 2. In the absence of the foregoing disclosure recited in amended independent claims 1 and 2, anticipation cannot be found. See, e.g., W.L. Gore & Associates v. Garlock, Inc., 220 USPQ 303, 313 (Fed. Cir. 1983), cert. denied, 469 U.S. 851 (1984) ("Anticipation requires the disclosure in a single prior art reference of each element of the claim under consideration"); Continental Can Co. USA v. Monsanto Co., 20 USPQ2d 1746, 1748 (Fed. Cir. 1991) ("When more than one reference is required to establish

unpatentability of the claimed invention anticipation under § 102 can not be found".); Lindemann Maschinenfabrik GmbH v. American Hoist & Derrick Co., 221 USPQ 481, 485 (Fed. Cir. 1984) (emphasis added) ("Anticipation requires the presence in a single prior art reference disclosure of each and every element of the claimed invention, arranged as in the claim").

Stated otherwise, there must be no difference between the claimed invention and the reference disclosures, as viewed by a person of ordinary skill in the field of the invention. This standard is clearly not satisfied by the Okazaki, Takagi and Zumeris disclosures for the reasons stated above. Furthermore, Okazaki, Takagi and Zumeris do not suggest the claimed subject matter and, therefore, would not have motivated one skilled in the art to modify the ultrasonic vibration motor, the vibration driven motor, and the ceramic motor disclosed by Okazaki, Takagi and Zumeris, respectively, to arrive at the claimed invention.

Amended claims 3/1, 6/1, 9, 11/1, 13 and 18 depend on and contain all of the limitations of amended independent claims 1 and 2, respectively, and, therefore, distinguish from the references at least in the same manner as claims 1 and 2.

In view of the foregoing, applicants respectfully request that the rejection of claims 1, 2, 3/1, 6/1, 9, 11/1, 13, 16 and 18 under 35 U.S.C. §102(a) as being clearly anticipated by Okazaki, Takagi or Zumeris be withdrawn.

Claim 17 was rejected under 35 U.S.C. §102(a) as being clearly anticipated by Kataoka or Shirasaki. Applicants respectfully traverse this rejection and submit that amended independent claim 17 recites subject matter which is not identically disclosed or described in Kataoka and Shirasaki.

Independent claim 17 is directed to an ultrasonic motor and requires a vibrating body having a piezoelectric element for vibrating the vibrating body, a moving body rotationally driven by a vibration of the vibrating body, and a pressurizing member for pressing the moving body into pressure contact with the vibrating body and for guiding rotational movement of the moving body.

Kataoka discloses a vibration type motor system which obtains a drive force by supplying frequency signals to electro-mechanical energy conversion elements provided on a vibration member. Shirasaki discloses a vibration driven motor for generating a travelling vibration wave on a vibration member by applying a voltage to an electro-mechanical energy conversion element.

However, neither Kataoka nor Shirasaki discloses or suggests an ultrasonic motor having a pressurizing member for pressing a moving body into pressure contact with a vibrating body and for guiding rotational movement of the moving body, as required by amended independent claim 17. Since Kataoka and Shirasaki do not disclose or describe the structural

combination of the ultrasonic motor recited in amended independent claim 17, there can be no anticipation by Kataoka and Shirasaki of independent claim 17 under 35 U.S.C. §102(a). That is, since each and every limitation of independent claim 17 is not found in Kataoka and Shirasaki, the references do not anticipate the claimed invention. See In re Lange, 209 USPQ 288, 293 (CCPA 1981). Furthermore, Kataoka and Shirasaki do not suggest the claimed subject matter and, therefore, would not have motivated one skilled in the art to modify Kataoka's vibration type motor system and Shirasaki's vibration driven motor to arrive at the claimed invention.

In view of the foregoing, applicants respectfully request that the rejection of claim 17 under 35 U.S.C. §102(a) as being clearly anticipated by Kataoka and Shirasaki be withdrawn.

Claims 1, 3/1, 6/1 and 18 were rejected under 35 U.S.C. §103(a) as being unpatentable over Japan '382 in view of Okazaki, Takagi or Zumeris. Applicants respectfully traverse this rejection and submit that the combined teachings of Japan '382 and Okazaki, Takagi or Zumeris do not disclose or suggest the subject matter recited in amended claims 1, 3/1, 6/1 and 18.

Amended independent claim 1 is directed to an ultrasonic motor and requires a vibrating body, a piezoelectric element disposed on the vibrating body for

generating a vibration wave to vibrate the vibrating body, the vibration wave having a vibration node disposed on a diagonal line of the vibrating body, at least one protrusion connected to the vibrating body for vibration therewith, the protrusion being disposed on the vibrating body at a position which does not correspond to the position of the vibration node, and a moving body disposed in contact with and driven by the protrusion during vibration thereof. No corresponding structural combination is disclosed or suggested by the combined teachings of Japan '382 and Okazaki, Takagi or Zumeris.

Japan '382 discloses a planar ultrasonic actuator having planar vibration bodies arranged two-dimensionally on a base. Piezoelectric bodies are adhered to the planar vibration bodies for producing flex vibration in longitudinal and lateral directions. As recognized by the Examiner, Japan '382 does not disclose or suggest a moving body disposed in contact with and driven by a protrusion during vibration of the protrusion. Furthermore, Japan '382 does not disclose or suggest a piezoelectric element disposed on the vibrating body for generating a vibration wave having a vibration node disposed on a diagonal line of the vibrating body, and at least one protrusion connected to the vibrating body and disposed on the vibrating body at a position which does not correspond to the position of the vibration node, as required by amended independent claim 1.

The secondary references to Okazaki and Zumeris disclose an ultrasonic vibration motor and a ceramic motor, respectively. Okazaki and Zumeris do not disclose or suggest the structure of the ultrasonic motor recited in amended independent claim 1 as set forth above for the rejection of claims 1, 2, 3/1, 6/1, 9, 11/1, 13, 16 and 18 under 35 U.S.C. §102(a). Since Okazaki and Zumeris do not disclose or suggest these structural features, they do not cure the deficiencies of Japan '382 and, therefore, one of ordinary skill in the art would not have been led to modify the references to attain the claimed subject matter.

Amended claims 3/1, 6/1 and 18 depend on and contain all of the limitations of amended independent claim 1 and, therefore, distinguish from the references at least in the same manner as claim 1.

In view of the foregoing, applicants respectfully request that the rejection of claims 1, 3/1, 6/1 and 18 under 35 U.S.C. §103(a) as being unpatentable over Japan '382 in view of Okazaki and Zumeris be withdrawn.

Applicants respectfully submit that newly added claims 19-40 also patentably distinguish from the prior art of record.

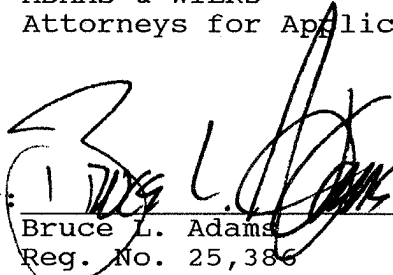
Claims 19-24, 25-39 and 40 depend on and contain all of the limitations of independent claims 1, 2 and 14, respectively, and, therefore, distinguish from the references at least in the same manner as claims 1, 2 and 14.

Moreover, there are separate grounds for patentability of several of the dependent claims which are directed to the specific structure of the vibrating body, the piezoelectric element, and the protrusions. No corresponding structure is disclosed or suggested by the prior art of record.

In view of the foregoing amendments and discussion, the application is believed to be in allowable form. Accordingly, favorable reconsideration and allowance of the claims are most respectfully requested.

Respectfully submitted,

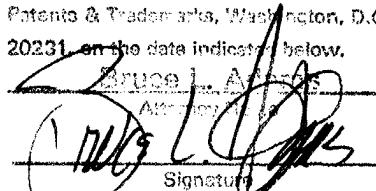
ADAMS & WILKS
Attorneys for Applicants

By: 
Bruce L. Adams
Reg. No. 25,386

50 Broadway - 31st Floor
New York, NY 10004
(212) 809-3700

MAILING CERTIFICATE

I hereby certify that this correspondence is being deposited with the United States Postal Service as first-class mail in an envelope addressed to: Commissioner of Patents & Trademarks, Washington, D.C. 20231, on the date indicated below.


Bruce L. Adams
Attorney
Signature
FEBRUARY 19, 2002
Date